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ABSTRACT

Rationale, Goals and objectives, grading procedures, methods of instruction and evaluation, and procedures for accomplishing objectives are included in this syllabus for a college course in marine education. The course is designed to provide preservice teachers with introductions to general teaching and marine methodologies; and to meet the needs of four different kinds of students: future marine science teachers, future science teachers with an interest in marine sciences, students wishing a brief introduction into marine education, and students wishing to do varying amounts of work in marine education teaching methods. Flexibility is allowed for the kind of student by completion of certain required objectives and by contract grading. The list of goals and objectives relates to all four types of students and includes designing a one-month unit of pre-college marine science study, accumulating enrichment materials and developing audiovisual and laboratory materials; objectives specific to science teaching are also included. Procedures for accomplishing objectives, listed in the final section of the syllabus, detail methods for smooth accomplishment of objectives. (CS)

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ED135644

# AN INTRODUCTION TO MARINE EDUCATION, A COURSE FOR PRESERVICE SCIENCE TEACHERS

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Abstract

The paper is syllibus of a course which is being offered for the first time in its present form during the spring semester of 1977. The course is designed to provide preservice teachers with introductions to two methodological areas. They are both marine and general methodologies. The course is not restricted to only preservice teachers, in fact, most sections are designed so that the complete course might generally suit the needs of the individual student. The course was developed with the support of the University of Maine Office of Sea Grant.

Ed M142 Teaching Science in the Secondary School
Module 14 Introduction to Marine Education

Ed X198 Problems in Education
1. Introduction to Marine Education
2. Advanced Studies in Marine Education

INTRODUCTION

The marine environment is a complete and dynamic system which embraces all of the sciences. This environment enjoys some of the deepest and darkest areas on the earth's surface as well as some of the earth's most populated areas. Some of this environment's inhabitants are among the most prolific known to man and some are among those soon to become extinct unless drastic conservation measures are quickly undertaken. The elements of the marine environment exist in delicate balances which are easily upset by unwise and uncontrolled environmental exploitation. Finally, the effects of marine weather often manifest themselves many hundreds of miles from the source of generation.

Man as a species is an integral segment of the marine environment. His eventual survival may very well depend upon his knowledge of this environment and how its many elements aid and affect contemporary man's survival. For example, much of earth's clean air supply is provided by the photosynthetic activity of marine phytoplanktonic organisms. Uncontrolled pollution will eventually take its toll of the planktonic community and as a result available oxygen supply will be vastly decreased. For reasons such as these, it is important that we provide our future citizens with as much education in the marine areas as is possible. Additionally, the rate at which the scientific world is advancing increases with each passing day. This advance requires that future American citizens be scientifically literate in the marine science areas so that they will be able to make reasonable decisions concerning potential hazards to this environment. Each advancing day requires that voting

citizens operate with less naivete concerning the marine world.

Educating people to a point of marine scientific literacy is not a simple task of short duration. Realistically, the process should begin in kindergarten and though the integrated efforts of educators at the various levels, continue as long as one remains in school. This requires not only a committment on the part of educators at all levels, but educating of teachers at all levels. The major purpose of this module is to introduce preservice teachers and others to the marine environment, teaching methods and procedures which will aid and facilitate a better understanding of this environment, and career opportunities in the marine sciences.

The title of the module/course noticeably omits the word "science". The omission is in keeping with current national trends. Educators long in the field of marine science education, now realize that bringing a future citizen to an acceptable degree of marine fluency is a difficult task. A task which requires the efforts and influence not only of science teachers and scientists, but the efforts and influence of those from all of the academic areas. Marine education is truly an educational endeavor which spans all academic barriers. A marine literate citizen has some facility and or feeling for science and the world ocean, marine economics, marine pollution, coastal and marine sociology, marine history, the history of waterborn transportation, music of the sea, marine art, and a host of other subjects.

As future science teachers and others generally interested in marine science, your task is an integral part of the total effort. However, science is not a panacea, the task at hand cannot be accomplished through science or science teaching alone. Don't be panacea prone there are many roads to Rome, encourage your colleagues in other areas to become involved. Marine education is a field for everyone. The survival of the world ocean requires the efforts of everyone.

Types of Students

Module 14/Ed X198 was designed to fit the needs of four different types of students. These four types are:

1. Future marine science teachers. This individual is normally but not necessarily a preservice science teacher who has an extremely strong interest in the marine environment. These persons are primarily interested in teaching marine sciences in the public schools. Additionally, their interest in teaching in the other science subject matter areas is subordinate to the marine sciences. This student will conduct the majority if not all of his/her science teaching methodology coursework in the marine science areas. For competencies gained and demonstrated this student will be awarded three credit hours.
2. Future science teachers with a secondary or tertiary interest in marine sciences. A student of this type is one who wishes a cursory introduction to marine science education materials and marine science teaching methodology. This student has completed all of the basic ED M142 requirements, and then has elected to do additional work for an honor grade. Within this context, arrangements may be made to complete part or all of the honor grade requirements within the marine area.
3. One Credit Hour Ed X198 Student. Students in this category wish a brief introduction to marine science teaching materials and methodology or wish to do a limited amount of advanced work in the marine areas. These students are not those normally enrolled in Ed M142 and need not have been in order to enroll for this course. Additionally, Ed M142 is not requisite for entry in this course. Those wishing to enroll should register for Ed X198, Problems in Education. Additional course title will be added to reflect the direction taken by the individual student.

4. Ed X198 Introduction to Marine Education/Advanced Studies in Marine Education Students. This type of student is one who wishes to do introductory, additional or advanced work in marine education teaching methodology. This type of student need not have a well founded background in science teaching methodology or even in the sciences. For work accomplished in this course, the student will be awarded three credit hours. The course structure will be determined by the needs of the student or in cases of multiple course registration, by the needs of the majority of students. Those interested in this course should register for Ed X198, Problems in Education. Additional course title will be assigned after course composition and directions are determine.

GOALS AND OBJECTIVES

As outlined above, this module/course is designed to fit the needs of four different types of students. The goals and objectives necessarily depend upon the student category. The following list of goals/objectives are all encompassing. Those relating to specific student categories are listed after the general list. The question of how a student reaches these goals is a function of the Procedures section. As a result of participation in this module/course, the student will be able to accomplish some or all of the following:

1. Locate , collect and evaluate materials for inclusion in pre-college marine science instruction at grades K-12.
2. Design and theoretically implement a one month unit of pre-college marine science study at the level of his choice. This design will take into account relevant psychological principles.
3. Locate and order equipment useful in pre-college marine science instruction.
4. Ascertain reading levels of marine science texts as a pre-requisite to their use at the student's level of interest.

5. Evaluate laboratory experiments in terms of their applications and usefulness at the pre-college level.
6. Locate marine science films and film bibliographies
7. Develop auto-tutorial marine science units (requires use of photographic and audio-equipment).
8. Locate marine science career education materials, discuss contemporary needs for personnel in marine fields and advise pre-college students concerning future projected marine science personnel needs.
9. Teach micro-marine science units.
10. Analyze marine science teaching styles in terms of their being instructor centered.
11. Evaluate marine science instruction as it is in progress, using Flander's Analysis.
12. Design visual materials which are effective complements to marine science instruction.
13. Survey and evaluate marine science field trip sites in terms of their complementary usefulness to the area of marine science being taught.
14. Develop marine science curriculum infusion units.
15. Evaluate films, filmstrips and filmloops and ascertain their usefulness in terms of level, subject matter, etc.
16. Conduct group discussions related to the marine environment.
17. Discuss at least the following pre-high school science programs; SAPA, SCIS, ESS.
18. Discuss the relevance of Piagetian development psychology and Lowenfeldian perceptual aptitude to successful science teaching.

GOALS/OBJECTIVES BY STUDENT CATEGORY

The numbers which preceed the descriptions reflect the student categories listed above.

1. Students in this category will be expected to accomplish all of the goals/objectives.
2. Students in this category will be expected to accomplish goals/objectives 1, 6, 8, 14, 15. Upon accomplishment of these goals, the student will be awarded one module credit. Students wishing to contract for a second module credit will be required to reach goal/objective 2. Additionally, students electing to take two module credits in the marine areas will be expected to be generally conversant in all of the goal/objective areas.
3. Students in this category will be expected to accomplish goals/objectives 1, 2, 3, 4, 5, 7, 15.
4. Students in this category will be expected to accomplish all of the goals/objectives if this person is working at the introductory level. If the student is working at the advanced level, goal/objective 2 must be accomplished. Additionally, the advanced student pursues studies based upon his/her needs, background and experience. Arrangements on the part of the advanced student, for the studies mentioned, will be made at the time of course registration.

GRADING

All students who enroll in these modules/courses will be graded on a contract basis. The grading requirements are included in categories 1-4 on the following page. These categories reflect the student categories listed above. Individual contracts may be negotiated with the instructor in special

cases. All students, regardless of the category in which they fall will be expected to reach all of the goals/objectives listed in their category for the grade of C. The A and B grade requirements are listed below.

All students will be required to pass all examinations which may be given. These examinations will be graded on a pass/fail basis. Students who fail to achieve the criterion level on an examination will be awarded a grade of unsatisfactory. A grade of unsatisfactory may be changed to satisfactory by taking a second examination. Students may expect second examinations to be similar to but not the same as the original. In the case of the final examination, second examinations will hot be given. Failure to achieve criterion level on the final examination will result in a voiding of the student's contract. In this case, the students course work will be reviewed. If all work which has been submitted is superior, the contracted grade will be awarded. In the event that the submitted work has been average or marginal, the student may expect to be awarded a letter grade which is one less than the contracted grade.

1. A. For the grade of A, the student must accomplish all of the goals listed above (for this type of student). In addition, the student must spend at least 16 hours of classroom observation in the marine education field, and submit one additional one month marine science unit. The additional unit may be an extension of the required one month unit or may be in a different marine science area depending upon the needs and interests of the student.

   B. For a grade of B, the student must accomplish all of the goals listed above. In addition, the student must spend at least 16 hours of classroom observation in the marine education field.

2. This is a pass/fail category. Students in this category are expected to accomplish the goals/objectives listed for them at an acceptable level.

3. A. For a grade of A the student must accomplish all of the goals listed previously, for this type of student. In addition, the student must spend at least 6 hours of classroom observation in the marine education field and submit one additional two week marine science unit. The additional unit may be an extension of the required one month unit or it may be in a different marine science area. This choice depends upon the needs and desires of the student.

   B. For a grade of B, the student must accomplish all of the goals listed previously, In addition, the student must spend at least 6 hours of classroom observation in the marine education field.

4. Students in this category who are working at the introductory level will be held to the same grading scheme as students who fall into category one. Honor grades for students operating at the advanced level will be arranged on an individual basis. However, the advanced student will be expected to achieve the goal/objective which is listed for a grade of C.

TEXT

The text which is prescribed generally for Ed M142 is also required for students falling in categories 1, 2, and the introductory level of category 4. Additionally, all students will be required to have and use:

Scientific American, The Ocean. San Francisco: W. H. Greeman and Company, 1969.

Lecture Discussion Sessions

There will be one 1½ hour lecture/discussion session held each week. These sessions will begin the second week following the beginning of the semester. The lecture/discussion session is designed for all students in all categories and all students will be expected to attend regularly. The location and time of these sessions will be arranged at the first meeting. During the sessions, the various topics covered in The Ocean will be discussed. These sessions , additionally, will serve as a forum for problems related to the students' individual study.

Evaluation

There are several categories of evaluation, each of which is listed below:

1. Written materials--these materials will be evaluated using an unsatisfactory, satisfactory, and satisfactory plus hierarchy. In cases which result in an unsatisfactory evaluation, the student is obligated to make the suggested corrections and resubmit. A section whose evaluation is raised from unsatisfactory to satisfactory will satisfy the terms of the student's contract.
2. Non-written materials--in cases where written materials are not specifically called for as part of the objective, evaluation will be made during a conference with the instructor. The student is obligated to arrange these conferences.
3. General Exams--there will be three criterion referenced general exams.
   A. Exam 1--
      1) Students who fall in category #2 will be expected to take the general Ed M142 exam. This exam is normally given on the last class meeting of the fifth week of classes.

2) Students who fall in categories 1, 3, and 4 will be examined during the lecture discussion session held in the fifth week of the semester. This examination will cover the topics discussed during weekly sessions 1-4. Additionally, students in categories 1 and the introductory level of category 4 will be expected to respond to questions concerning perceptual aptitude, developmental psychology, types of instruction, and curriculum design. The student may be aided in his/her study for this exam by consulting various volumes of Journal of Research in Science Teaching, especially volume 2.

B. Exam 2

This exam will be administered at the lecture/discussion during the tenth week of the semester. The exam will be taken by all marine education students. Its content will relate primarily to the material covered during the weeks 6-9. A minority portion of the exam will be related to work accomplished during the first five weeks of the semester.

C. Final Exam

This exam will be cirterion referenced and cover the entire contents of the course or module. If the student is taking this module as a requirement for an honor grade in the general Ed M142 course, testing will be in accordance with the general course requirements. For students falling in the other categories, the exam will be held during the normally scheduled university examination week. The final exam will be held during the time and at the location listed for the Ed M142 examination. Students should check the university examination schedule for this time and location.

Deadlines

All written work which the student wishes to have considered as part of that which satisfies the various module/course requirements must be submitted not later than 10 school days prior to the last regularly scheduled school day of the semester. Those who are unable to meet this deadline should consult the instructor and discuss alternatives.

Make up examinations, in the case of those receiving a U on the first testing, must, if they so desire, take a second exam within one school week after the first exam is returned.

Procedures

The following list of procedures will serve to move the student smoothly through his/her work. The procedure numbers and the goals/objectives numbers are the same. Listed then, under procedure #1 are the steps to be followed in accomplishing goal/objective #1, etc. The student should pick those combinations of procedures which will allow him/her to reach the various goals/objectives required of his/her category.

1. A. Locate and describe at least five references from each of the following sources. Your description should include type of information (tides, currents, inter-tidal ecology, plankton, etc.), age group or grade level to which material is applicable, author, source, etc.

   1) Readers Guide to Periodical Literature
   2) Education Index
   3) Current Index to Journals in Education (CIJE)
   4) Resources in Education (ERIC)
   5) Masters Thesis in Education
   6) Dissertation Abstracts

   B. Obtain a bibliography and/or curriculum guide materials from your instructor. Compare and contrast 5 curriculum guides, and discuss the strong and weak points of each. This comparison and discussion may be submitted in outline form to the instructor.

2. Design a one month marine science unit for use sometime during the course of the school year. You may make whatever assumptions you wish; however, these should be made known. For example, you may wish to design a unit which does not require prerequisites, or you may wish to assume a year of ESCS, some other biology background, some chemistry background, etc. Your unit need not necessarily be a high school unit (discuss your plan with the instructor). In your development, you should take into account the number of classroom and laboratory hours per week, field experiences and other things important to your needs. Remember, this is a teaching unit, not a resource unit.

Your unit should be put into some coherent scheme, and typed prior to being submitted. An outline scheme which might be followed is as follows:

Introduction
Objectives
Goals
Materials
Procedures
Evaluation
Suggestions for further study
Bibliography
Vocabulary

This is not the only scheme, there are many others which may be better suited to your needs. Schemes of this type usually follow an outline form and each entry under a subject heading is give a number.

Objectives
    1.
    2.
    3.
Goals
    1.
    2.
    3.

3. With your unit plan, submit a discusssion of where you plan to obtain your materials as well as the listings from supply house catalogs. This listing should include unit price, total price, stock number, item description, etc.

   Also, remember that shcool budgets for science materials are often limited. You may build your own equipment if you desire. In this case describe the process through which you go.

4. Using Fry's readability formula (your instructor has a handout covering this formula) or some other; there are several in the literature; determine the reading level of at least five of the following texts. Most are available in the Fogler Library. Before beginning, develop some system and then hold that system constant for all the texts. One example is to start with the first full paragraph on page 5 and determine the reading level. Continue this way with every 50th page using the first full paragraph on each page as a beginning point. If a page has pictures, charts, etc., advance to the next usable page. When this task is completed, discuss your data with the instructor.

Bartsch, Paul. Mollusks, Dover Publications, Inc. New York, 1968.

Carlisle, Norman. Riches of the Sea. Sterling Publishing Co., Inc. New York, 1967.

Carson, Rachel. The Sea Around Us., Signet Science Library, New York, 1961.

Carson, Rachel. Under the Sea Wind., Signet Science Library, New York, 1941.

Carson, Rachel. The Edge of the Sea., Signet Science Library, New York, 1955.

Clark, Culsa. M., Starfishes and Their Relations, Trustees of the British Museum (Natural History)., London, 1968.

Coker, R. E. This Great and Wide Sea. Harper & Row, New York, 1962.

Doyle, William F. Nonvascular Plants: Form and Function. Wadsworth Publishing Co., Inc. Belmont, California, 1965.

Green, J. The Biology of Estuarine Animals. Billing & Sons, Limited, London, 1968.

Guberlet, Muriel. Explorers of the Sea. The Ronald Press, Co., New York, 1964.

Hay, John, and Farb, Peter. The Atlantic Shore, Harper & Row Publishers, Inc., New York 1966.

Jorgensen, C. Baker. Biology of Suspension Feeding. Pergamon Press, New York, 1966.

Niering, William A. The Life of the Marsh. McGraw-Hill, New York, 1966.

Russell-Hunter, W. D. A Biology of Lower Invertebrates. Macmillan Co., New York, 1968.

Russell-Hunter, W. D. A Biology of Higher Invertebrates. Macmillan Co., New York, 1969.

Shute, et. al, An Introduction to Navigation and Nautical Astronomy. Macmillan Co., New York , 1944.

Tait, R. V. Elements of Marine Ecology., R. J. Acford Ltd., Chichester, England, 1968.

Teal, John and Teal, Mildred. Life and Death of the Salt Marsh. Little, Brown & Co., Boston, 1969.

Williams, Jerome, Oceanography. Little, Brown,& Co., Boston, 1962.

Yonge, C. M. The Sea Shore. Antheneum, New York, 1963.

The student may make arrangements with the instructor to substitute texts for those listed above.

5. Using the bibliography supplied to you for use in procedure #1, locate at least 10 marine science laboratory experiements. Evaluate these experiments. Evaluate these experiments in terms of their applications and usefulness at the precollege level. Submit these evaluations to your instructor. You should also provide a complete literature citation for each evaluation.

6. Using library, classroom, film library and other sources, locate 5 marine education film bibliographies. Submit the citations for these bibliographies.

7. A. Using your course methods text as well as library sources, investigate audio-tutorial instruction, the lecture demonstration method of instruction, laboratory instruction, individualized instruction, the curriculum infusion method. Define and submit your definition of each of these types of instruction.

   B. Obtain film, tapes, and camera from the instructor. Using this equipment, develop a one-half hour audio-tutorial unit of instruction. For a guide you may consult the Ed C140 A-T units.

   This unit may include manipulation of equipment and materials by your intended students or it may not. In any event, you should use the visual channel to complement the audio channel.

8. Locate 10 sources of marine science career education information.

   A. List and submit 25 employment areas open to individuals with some type of marine science background. With your listing, include whatever educational prerequisites are required to obtain employment in these areas; if special education is not required, please indicate this.

   B. Locate and write a critique of at least two documents which discuss contemporary needs for personnel in the marine education areas.

   C. Conduct a 15 minute lecture at any K-12 level. The subject of this lecture should be "A Career in the Marine World". Consult your instructor concerning arrangements for this lecture.

9. Design a 15 minute micro-marine science lesson. You may use any teaching style you wish or which you think will be most effective. When this is completed, consult your instructor. You will be required to present this lesson to a group of your classmates, probably about six people. Following the teaching session the group will critique the lesson.

   The subject matter need not be profound, a well taught lesson in-

volving a simple concept is better than a poorly taught lesson involving highly technical material.

10. This goal/objective will be accomplished by evaluating the instruction of your fellow classmates as presented in procedure #9. Procedure #11 should be accomplished prior to #9, #10. A critique of one of these instructional periods should be submitted.

11. A. Obtain and listen to the slide tape discussion of Flanders Analysis as is normally covered in module 2 of Ed M142.

    1) Evaluate one of the micro-lessons presented by your classmates or, if this is not possible, persue "B" below.

    2) Using Flanders Analysis, evaluate one video tape of a science class. There are several of these from which to choose. All tapes are of public high school science classes.

    B. This is a group activity. You should find four or five fellow students with whom you can work.

    1) View at least five video tapes of public school science teaching situations. These tapes are available in the science lab.

    2) Compare and contrast each teaching situation in a group discussion.

    3) As a group, discuss the strengths and weaknesses of each teaching situation with your instructor.

12. Make and submit at least one each of the following aids.

    A. Overhead projection
    B. Poster
    C. Demonstration

These materials may be made to complement one of the units you are designing.

13. This goal/objective will be accomplished during a one day field trip to the Mt. Desert Island area. During this trip, a rocky shore, sandy beach, and mud flat will be evaluated. The trip will take place during the latter portion of the spring semester and the early portion of the fall semester.

14. A curriculum infusion unit is one which is inserted in an already established curriculum. This type of unit may be as short as one class session or much longer to fit individual needs.

    Design, write and submit a marine science curriculum infusion unit which will take at least one normal class session.

15. A. Obtain the following film from the University of Maine Film Library in the basement of Shibles Hall: The Restless Sea by Walt Disney
    1) View film--this can be done in the film library's viewing booth or in any of the science edcuation classrooms/laboratories.
    2) Write and submit a brief review of the film. In your review include discussions of its applicability to pre-college marine science teaching.
    3) Write and submit your definition of the Marine Environment.

    B. Write and submit an evaluation of marine science related 8mm film loop and one 35 mm filmstrip. Some of these media are available in the laboratory.

16. Conduct a 15 minute group discussion concerning some aspect of the marine environment. You will act as a facilitator of the discussion. If you desire this may be done as an add-on to your micro-teaching session.

17. Obtain the SAPA, SCIS, and ESS programs from your instructor. Compare and contrast these programs in writing and submit this writing.

18. A. Obtain two modules involving Piagetian developmental psychology from your instructor.

1) Take the Piagetian test which is involved. This will be followed sometime later by a group discussion concerning the subject.

2) Briefly discuss and submit the possible implications of Piagetian psychology to marine science curriculum design. You may be aided in completion of this discussion by consulting those publications in the bibliography which are related to Piagetian psychology.

B. Review literature which describes and discusses the Lowenfeldian visual-haptic continuum. Additionally, read the articles by Erickson (consult your instructor prior to beginning this phase).

1) Define and submit your definition of the visual-haptic continuum.

2) Discuss in writing the possible relevance of Lowenfeldian perceptual aptitude to the teaching of science, especially in the marine areas.

Contracts

Contracts must be submitted by the end of the second week of the semester. Following the submission of the initial contract, the student may upgrade or downgrade the initial contract at any time.

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